STANDARDIZED

UXO TECHNOLOGY DEMONSTRATION SITE

BLIND GRID SCORING RECORD NO. 830

SITE LOCATION:
U.S. ARMY ABERDEEN PROVING GROUND

DEMONSTRATOR:
NAEVA GEOPHYSICS INC.
P.O. BOX 7325
CHARLOTTSVILLE, VA   22906

TECHNOLOGY TYPE/PLATFORM:
AN/PSS-14 EM/HANDHELD

PREPARED BY:
U.S. ARMY ABERDEEN TEST CENTER
ABERDEEN PROVING GROUND, MD   21005-5059

OCTOBER 2007

DISPOSITION INSTRUCTIONS

CSTE-DTC-AT-SL-E

MEMORANDUM FOR RECORD

SUBJECT: Operations Security (OPSEC) Review of Paper/Presentation

1. The attached record entitled "The Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 830" dated October 2007 is provided for review for public disclosure in accordance with AR 530-1 as supplemented. The scoring record is proposed for public release via the internet.

2. I, the undersigned, am aware of the intelligence interest in open source publications and in the subject matter of the information I have reviewed for intelligence purposes. I certify that I have sufficient technical expertise in the subject matter of this report and that, to the best of my knowledge, the net benefit of this public release outweighs the potential damage to the essential secrecy of all related ATC, DTC, ATEC, Army or other DOD programs of which I am aware.

Dennis Teefy		September 2007
NAME (Printed)	SIGNATURE	DATE

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None.

14. ABSTRACT

This Scoring Record documents the efforts of NAEVA Geophysics, Inc., to detect and discriminate inert unexploded ordnance (UXO) utilizing the APG Standardized UXO Technology Demonstration Site Blind Grid. This Scoring Record was coordinated by Dennis Teefy and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Command, and the U.S. Army Aberdeen Test Center.

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NAEVA, UXO Standardized Technology Demonstration Site, Blind Grid, Dual-Sensor Instrument/handheld, MEC.

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i

TABLE OF CONTENTS

SECTION 4.   TECHNICAL PERFORMANCE RESULTS

SECTION 5.   ON-SITE LABOR COSTS

SECTION 6.   COMPARISON OF RESULTS TO BLIND GRID DEMONSTRATION

SECTION 7.   APPENDIXES

SECTION 1. GENERAL INFORMATION

1.1 BACKGROUND

Technologies under development for the detection and discrimination of munitions and explosives of concern (MEC) - i.e. unexploded ordnance (UXO) and discarded military munitions (DMM) require testing so that their performance can be characterized. To that end, Standardized Test Sites have been developed at Aberdeen Proving Ground (APG), Maryland and U.S. Army Yuma Proving Ground (YPG), Arizona. These test sites provide a diversity of geology, climate, terrain, and weather as well as diversity in ordnance and clutter. Testing at these sites is independently administered and analyzed by the government for the purposes of characterizing technologies, tracking performance with system development, comparing performance of different systems, and comparing performance in different environments.

The Standardized UXO Technology Demonstration Site Program is a multi-agency program spearheaded by the U.S. Army Environmental Command (USAEC). The U.S. Army Aberdeen Test Center (ATC) and the U.S. Army Corps of Engineers Engineer Research and Development Center (ERDC) provide programmatic support. The program is being funded and supported by the Environmental Security Technology Certification Program (ESTCP), the Strategic Environmental Research and Development Program (SERDP) and the Army Environmental Quality Technology Program (EQT).

1.2 SCORING OBJECTIVES

The objective in the Standardized UXO Technology Demonstration Site Program is to evaluate the detection and discrimination capabilities of a given technology under various field and soil conditions. Inert munitions and clutter items are positioned in various orientations and depths in the ground.

The evaluation objectives are as follows:

a. To determine detection and discrimination effectiveness under realistic scenarios that may vary targets, geology, clutter, topography, and vegetation.

b. To determine cost, time, and manpower requirements to operate the technology.

c. To determine demonstrator's ability to analyze survey data in a timely manner and provide prioritized "Target Lists" with associated confidence levels.

d. To provide independent site management to enable the collection of high quality, ground-truth, geo-referenced data for post-demonstration analysis.

1.2.1 Scoring Methodology

a. The scoring of the demonstrator's performance is conducted in two stages. These two stages are termed the RESPONSE STAGE and DISCRIMINATION STAGE. For both stages, the probability of detection (P_d) and the false alarms are reported as receiver-operating

characteristic (ROC) curves. False alarms are divided into those anomalies that correspond to emplaced clutter items, measuring the probability of false positive (P_{fp}), and those that do not correspond to any known item, termed background alarms.

b. The RESPONSE STAGE scoring evaluates the ability of the system to detect emplaced targets without regard to ability to discriminate ordnance from other anomalies. For the blind grid RESPONSE STAGE, the demonstrator provides the scoring committee with a target response from each and every grid square along with a noise level below which target responses are deemed insufficient to warrant further investigation. This list is generated with minimal processing and, since a value is provided for every grid square, will include signals both above and below the system noise level.

c. The DISCRIMINATION STAGE evaluates the demonstrator's ability to correctly identify ordnance as such and to reject clutter. For the blind grid DISCRIMINATION STAGE, the demonstrator provides the scoring committee with the output of the algorithms applied in the discrimination-stage processing for each grid square. The values in this list are prioritized based on the demonstrator's determination that a grid square is likely to contain ordnance. Thus, higher output values are indicative of higher confidence that an ordnance item is present at the specified location. For digital signal processing, priority ranking is based on algorithm output. For other discrimination approaches, priority ranking is based on human (subjective) judgment. The demonstrator also specifies the threshold in the prioritized ranking that provides optimum performance, (i.e. that is expected to retain all detected ordnance and rejects the maximum amount of clutter).

d. The demonstrator is also scored on EFFICIENCY and REJECTION RATIO, which measures the effectiveness of the discrimination stage processing. The goal of discrimination is to retain the greatest number of ordnance detections from the anomaly list, while rejecting the maximum number of anomalies arising from non-ordnance items. EFFICIENCY measures the fraction of detected ordnance retained after discrimination, while the REJECTION RATIO measures the fraction of false alarms rejected. Both measures are defined relative to performance at the demonstrator-supplied level below which all responses are considered noise, i.e., the maximum ordnance detectable by the sensor and its accompanying false positive rate or background alarm rate.

e. All scoring factors are generated utilizing the Standardized UXO Probability and Plot Program, version 3.1.1.

1.2.2 Scoring Factors

Factors to be measured and evaluated as part of this demonstration include:

a. Response Stage ROC curves:

(1) Probability of Detection (P_d^{res}).

(2) Probability of False Positive (P_{fp}^{res}).

(3) Background Alarm Rate (BAR^{res}) or Probability of Background Alarm (P_{BA}^{res}).

b. Discrimination Stage ROC curves:

(1) Probability of Detection (P_d^{disc}).

(2) Probability of False Positive (P_{fp}^{disc}).

(3) Background Alarm Rate (BAR^{disc}) or Probability of Background Alarm (P_{BA}^{disc}).

c. Metrics:

(1) Efficiency (E).

(2) False Positive Rejection Rate (R_{fp}).

(3) Background Alarm Rejection Rate (R_{BA}).

d. Other:

(1) Probability of Detection by Size and Depth.

(2) Classification by type (i.e., 20-mm, 40-mm, 105-mm, etc.).

(3) Location accuracy.

(4) Equipment setup, calibration time and corresponding man-hour requirements.

(5) Survey time and corresponding man-hour requirements.

(6) Reacquisition/resurvey time and man-hour requirements (if any).

(7) Downtime due to system malfunctions and maintenance requirements.

1.3 STANDARD AND NONSTANDARD INERT ORDNANCE TARGETS

The standard and nonstandard ordnance items emplaced in the test areas are listed in Table 1. Standardized targets are members of a set of specific ordnance items that have identical properties to all other items in the set (caliber, configuration, size, weight, aspect ratio, material, filler, magnetic remanence, and nomenclature). Nonstandard targets are ordnance items having properties that differ from those in the set of standardized targets.

TABLE 1. INERT ORDNANCE TARGETS

Standard Type	Nonstandard (NS)
20-mm Projectile M55	20-mm Projectile M55
	20-mm Projectile M97
40-mm Grenades M385	40-mm Grenades M385
40-mm Projectile MKII Bodies	40-mm Projectile M813
BDU-28 Submunition	
BLU-26 Submunition	
M42 Submunition	
57-mm Projectile APC M86	
60-mm Mortar M49A3	60-mm Mortar (JPG)
	60-mm Mortar M49
2.75-inch Rocket M230	2.75-inch Rocket M230
	2.75-inch Rocket XM229
MK 118 ROCKEYE	
81-mm Mortar M374	81-mm Mortar (JPG)
	81-mm Mortar M374
105-mm HEAT Rounds M456	
105-mm Projectile M60	105-mm Projectile M60
155-mm Projectile M483A1	155-mm Projectile M483A
	500-lb Bomb
	M75 Submunition

HEAT   = high-explosive antitank
JPG   = Jefferson Proving Ground

SECTION 2.   DEMONSTRATION

2.1   DEMONSTRATOR INFORMATION

2.1.1   Demonstrator Point of Contact (POC) and Address

POC: Mr. John Breznick
           (434) 978 3187

Address: NAEVA Geophysics Inc.
          P.O. Box 7325
          Charlottesville, VA   22906

2.1.2   System Description (provided by demonstrator)

NAEVA will be using two instruments manufactured by CyTerra Corporation, the AN/PSS-14 and the LULU, in a comparison with the Geonics EM61 MK2 and the Geonics EM61 HH.

The AN/PSS-14 is a handheld mine detection system designed to accurately detect both metallic and nonmetallic landmines. The unit was originally designed for military countermine operations, but attempts are currently underway to adapt it for humanitarian demining applications. A handheld staff supports a single sensor that utilizes fully integrated ground penetrating radar (GPR) and metal detection to identify large and small, metallic, and nonmetallic mines. The GPR technology is based on a wide-band, coherent, stepped-frequency radar transceiver. The search head contains one transmit and two receive antennas. The transmit antenna produces continuous wave, low-power radar signals that are reflected back to the receive antennas by subsurface discontinuities and processed by the system. The metal detector consists of a flat annular coil that forms the diameter of the sensor head and surrounds the GPR antennas. The single coil acts as both transmitter and receiver. NAEVA will be testing the AN/PSS-14 at the Non-Metallic Test Stand at APG, as well as the calibration lanes, blind grid, and the mine grid. In the calibration lanes, blind grid, and mine grid, the instrument will be used to flag targets, the locations of which will be recorded later using RTK GPS.

The LULU represents a transition of the CyTerra AN/PSS-14 mine detection technology to provide the capability to detect buried utilities (fig. 1). The system incorporates a derivative of the AN/PSS-14 GPR. To make it suitable for utility detection, the frequency band and antenna size of the system were altered to increase the depth-detection range from shallow mine depths of inches to between 2 and 10 feet for utility detection. NAEVA and CyTerra feel that this increased depth of exploration may make the system suitable for detection of the deeper targets commonly associated with UXO remediation projects. The LULU will be employed only for follow-up at flagged target locations identified from the AN/PSS-14. Based on the results of this project, the frequencies and antenna size could be modified at a later date to maximize its UXO detection capabilities.

A Geonics EM61 MK2 will be used to map the calibration lanes, blind grid, and mine grid for a direct comparison with the results from the AN/PSS-14. The EM61 HH will be used on the Non-Metallic Test Stand, calibration lanes, blind grid, and mine grid. The coil size of the EM61 HH is similar to that of the AN/PSS-14, providing a good comparison of an electromagnetic (EM)-only instrument with the capabilities of the EM- and GPR-equipped AN/PSS-14.

On-ground control stakes for the demonstration will be established using an Ashtech ZFX RTK GPS. The Ashtech Z-FX system consists of a mobile GPS receiver and antenna (rover) and a fixed base station utilizing an Ashtech Z-FX receiver. Real-time corrections from the GPS base receiver are broadcast to the rover via a radio link using Pacific Crest radio modems. This system provides positional updates at a rate of 1 Hz, with a horizontal accuracy of 3 cm.

Figure 1. Demonstrator's system, AN/PSS-14/handheld.

2.1.3 Data Processing Description (provided by demonstrator)

For the Non-Metallic Test Stand portion of the demonstration, data collected with the AN/PSS-14 will be stored in a laptop computer. These data will be processed by CyTerra using proprietary software to quantify the responses from each of the tested inert OE items. Data will not be stored during the calibration lanes, blind grid, and mine grid surveys with the AN/PSS-14, as the instrument will be used to select targets in real time, with selected anomalies marked with PVC pin flags.

All data collected with the Geonics EM61 MK2 and EM61 HH will be processed using Geosoft's Oasis Montaj software. In the calibration lanes, blind grid, and mine grid a track plot of the instrument's GPS positions will be created to ensure that adequate data coverage had been achieved. Preliminary contour maps will then be created for field review of the data generated by each sensor within a survey area. Once in-field processing and review is completed, the data will be electronically transferred to a remote site for analysis/target selection.

Geosoft's Oasis Montaj UXO software package will be employed to post-process and contour the raw data and to identify potential UXO targets from each sensor's data. The program identifies peak amplitude responses of the frequency associated with, but not limited to, UXO items. Anomalies may generate multiple target designations depending on individual signature characteristics.

Standard geophysical data processing includes the following:

•Instrument drift correction (leveling).

•Lag correction.

•Digital filtering and enhancement (if necessary).

•Gridding of data.

•Selection of anomalies.

•Preparation of geophysical and target maps.

Once the steps described above have been completed, the data will be ready for fusion, advanced processing, and final dig list development. The processing steps required to remove unwanted signal from the geophysical data are usually site specific but there are general procedures that can be used. Low-pass filters are first applied to remove very high frequency responses from the geophysical data that are normally due to sensor noise and/or platform vibration. These filters can also be applied to the positioning data to remove variations in the positioning data that are of too high a frequency to be realistic. Demedian filters or similar processes that remove long wavelength features are useful for removing both geologic response as well as sensor drift (EM).

2.1.4 Data Submission Format

Data were submitted for scoring in accordance with data submission protocols outlined in the Standardized UXO Technology Demonstration Site Handbook. These submitted data are not included in this report in order to protect ground truth information.

2.1.5 Demonstrator Quality Assurance (QA) and Quality Control (QC) (provided by demonstrator)

QC. To establish confidence in the data reliability, tests will be conducted in a systematic manner throughout the duration of the fieldwork. Various types of quality control data are generated prior to and after all data collection sessions.

Daily. A location identified as having no subsurface metal will be designated as a calibration point. Readings will be collected in a stationary position over the calibration point to ensure a stable and repeatable response is exhibited. During this time, a metallic item will be placed below the center of the sensors, and the instrument's response will be observed. The item will then be removed, and static readings continued. This test is performed daily to establish that the instrument is functioning properly, as indicated by a stable and repeatable response. The calibration point will also document the continued accurate performance of the laser positioning equipment.

QA. For purposes of this proposal, QA is defined as the procedures to be employed during the demonstration. All of the procedures are designed to provide excellent data quality while maximizing production during the field efforts.

All data in the calibration lanes, blind grid, and mine grid collected with the Geonics EM61 MK2 and EM61 HH will be positioned with RTK GPS using an antenna mounted directly above the sensor. Data will be collected at a rate of 1 Hz. Existing control markers will be sufficient to maintain straight line profiling and to achieve full coverage within the calibration lanes and the blind grid. Within each survey cell, data collection will be controlled using a series of marked survey ropes positioned at 25-foot intervals perpendicular to the survey line direction. Alternating colors painted on the ropes at 3-foot intervals facilitate straight line profiling with the instrumentation during data collection.

2.1.6 Additional Records

The following record(s) by this vendor can be accessed via the Internet as MicroSoft Word documents at www.uxotestsites.org.

2.2 APG SITE INFORMATION

2.2.1 <u>Location</u>

The APG Standardized Test Site is located within a secured range area of the Aberdeen Area of APG. The Aberdeen Area of APG is located approximately 30 miles northeast of Baltimore at the northern end of the Chesapeake Bay. The Standardized Test Site encompasses 17 acres of upland and lowland flats, woods, and wetlands.

2.2.2 <u>Soil Type</u>

According to the soils survey conducted for the entire area of APG in 1998, the test site consists primarily of Elkton Series type soil (ref 2). The Elkton Series consists of very deep, slowly permeable, poorly drained soils. These soils formed in silty aeolin sediments and the underlying loamy alluvial and marine sediments. They are on upland and lowland flats and in depressions of the Mid-Atlantic Coastal Plain. Slopes range from 0 to 2 percent.

ERDC conducted a site-specific analysis in May of 2002 (ref 3). The results basically matched the soil survey mentioned above. Seventy percent of the samples taken were classified as silty loam. The majority (77 percent) of the soil samples had a measured water content between 15- and 30-percent with the water content decreasing slightly with depth.

For more details concerning the soil properties at the APG test site, go to www.uxotestsites.org on the web to view the entire soils description report.

2.2.3 <u>Test Areas</u>

A description of the test site areas at APG is included in Table 2.

TABLE 2. TEST SITE AREAS

Area	Description
Calibration grid	Contains 14 standard ordnance items buried in six positions at various angles and depths to allow demonstrator equipment calibration.
Blind grid	Contains 400 grid cells in a 0.2-hectare (0.5 acre) site. The center of each grid cell contains ordnance, clutter, or nothing.

SECTION 3.   FIELD DATA

3.1   DATE OF FIELD ACTIVITIES (17, 19, 20, 24 through 28, and 31 July and 1 and 3 August 2006)

3.2   AREAS TESTED/NUMBER OF HOURS

Areas tested and total numbers of hours operated at each site are summarized in Table 3.

TABLE 3.   AREAS TESTED AND NUMBER OF HOURS

Area	Number of Hours
Calibration lanes	17.42
Blind grid	42.80

3.3   TEST CONDITIONS

3.3.1   Weather Conditions

An APG weather station located approximately 1 mile west of the test site was used to record average temperature and precipitation on a half-hour basis for each day of operation. The temperatures listed in Table 4 represent the average temperature during field operations from 0700 to 1700 hours while precipitation data represents a daily total amount of rainfall. Hourly weather logs used to generate this summary are provided in Appendix B.

TABLE 4.   TEMPERATURE/PRECIPITATION DATA SUMMARY

Date, 2006	Average Temperature, ^{o}F	Total Daily Precipitation, in.
17 July	90.82	0.00
19 July	83.48	0.00
20 July	83.21	0.00
24 July	81.47	0.00
25 July	81.27	0.00
26 July	84.25	0.00
27 July	86.61	0.05
28 July	84.45	0.10
31 July	86.52	0.57
1 August	91.22	0.00
3 August	92.49	0.00

3.3.2 Field Conditions

CyTerra/NAEVA surveyed the blind grid for two weeks starting on 17 July. The grid was wet and muddy during the last week of the survey due to periodic rain.

3.3.3 Soil Moisture

Three soil probes were placed at various locations within the site to capture soil moisture data: calibration, mogul, open field, and wooded areas. Measurements were collected in percent moisture and were taken twice daily (morning and afternoon) from five different soil depths (1 to 6 in., 6 to 12 in., 12 to 24 in., 24 to 36 in., and 36 to 48 in.) from each probe. Soil moisture logs are included in Appendix C.

3.4 FIELD ACTIVITIES

3.4.1 Setup/Mobilization

These activities included initial mobilization and daily equipment preparation and break down. A one-person crew took 1 hour to perform the initial setup and mobilization. There was 4 hours and 50 minutes of daily equipment preparation and end of the day equipment break down lasted 1 hour and 40 minutes.

3.4.2 Calibration

CyTerra/NAEVA spent a total of 17 hours and 25 minutes in the calibration lanes, of which 7 hours and 40 minutes was spent collecting data.

3.4.3 Downtime Occasions

Occasions of downtime are grouped into five categories: equipment/data checks or equipment maintenance, equipment failure and repair, weather, demonstration site issues, or breaks/lunch. All downtime is included for the purposes of calculating labor costs (section 5) except for downtime due to demonstration site issues. Demonstration site issues, while noted in the daily log, are considered non-chargeable downtime for the purposes of calculating labor costs and are not discussed. Breaks and lunches are discussed in this section and billed to the total site survey area.

3.4.3.1 Equipment/data checks, maintenance. Equipment data checks and maintenance activities accounted for 2 hours and 55 minutes of site usage time. These activities included changing out batteries and routine data checks to ensure the data was being properly recorded/collected. CyTerra/NAEVA spent an additional 10 hours and 10 minutes for breaks and lunches.

3.4.3.2 Equipment failure or repair. No time was needed to resolve equipment failures that occurred while surveying the blind grid.

3.4.3.3 <u>Weather.</u> Fourty five minutes of weather delays occurred during the survey. A lightning advisory stopped CyTerra/NAEVA from surveying on 28 July 28.

3.4.4 <u>Data Collection</u>

CyTerra/NAEVA spent a total time of 42 hours and 50 minutes in the blind grid area, 22 hours and 30 minutes of which was spent collecting data.

3.4.5 <u>Demobilization</u>

The CyTerra/NAEVA survey crew went on to conduct a full demonstration of the site. Therefore, demobilization did not occur until 3 August 2006. On that day, it took the crew 2 hours and 10 minutes to break down and pack up their equipment.

3.5 PROCESSING TIME

CyTerra/NAEVA submitted the raw data from the demonstration activities on the last day of the demonstration, as required. The scoring submittal data were also provided within the required 30-day time frame.

3.6 DEMONSTRATOR'S FIELD PERSONNEL

Field Survey: Brian Neely
Field Survey: Dan Hennessy
Field Survey: Josh Tabony
Field Survey: Ray Gill

3.7 DEMONSTRATOR'S FIELD SURVEYING METHOD

CyTerra surveyed the blind grid in a linear manner and surveyed the middle of all 400 grid cells, one at a time. CyTerra surveyed in a north to south direction.

3.8 SUMMARY OF DAILY LOGS

Daily logs capture all field activities during this demonstration and are located in Appendix D. Activities pertinent to this specific demonstration are indicated in highlighted text.

SECTION 4.   TECHNICAL PERFORMANCE RESULTS

4.1   ROC CURVES USING ALL ORDNANCE CATEGORIES

Figure 2 shows the probability of detection for the response stage (P_d^{res}) and the discrimination stage (P_d^{disc}) versus their respective probability of false positive. Figure 3 shows both probabilities plotted against their respective probability of background alarm. Both figures use horizontal lines to illustrate the performance of the demonstrator at two demonstrator-specified points: at the system noise level for the response stage, representing the point below which targets are not considered detectable, and at the demonstrator's recommended threshold level for the discrimination stage, defining the subset of targets the demonstrator would recommend digging based on discrimination. Note that all points have been rounded to protect the ground truth.

Figure 2.   AN/PSS-14/handheld blind grid probability of detection for response and
discrimination stages versus their respective probability of false positive over
all ordnance categories combined.

15

Figure 3. AN/PSS-14/handheld blind grid probability of detection for response and discrimination stages versus their respective probability of background alarm over all ordnance categories combined.

4.2 ROC CURVES USING ORDNANCE LARGER THAN 20 MM

Figure 4 shows the probability of detection for the response stage (P_d^{res}) and the discrimination stage (P_d^{disc}) versus their respective probability of false positive when only targets larger than 20 mm are scored. Figure 5 shows both probabilities plotted against their respective probability of background alarm. Both figures use horizontal lines to illustrate the performance of the demonstrator at two demonstrator-specified points: at the system noise level for the response stage, representing the point below which targets are not considered detectable, and at the demonstrator's recommended threshold level for the discrimination stage, defining the subset of targets the demonstrator would recommend digging based on discrimination. Note that all points have been rounded to protect the ground truth.
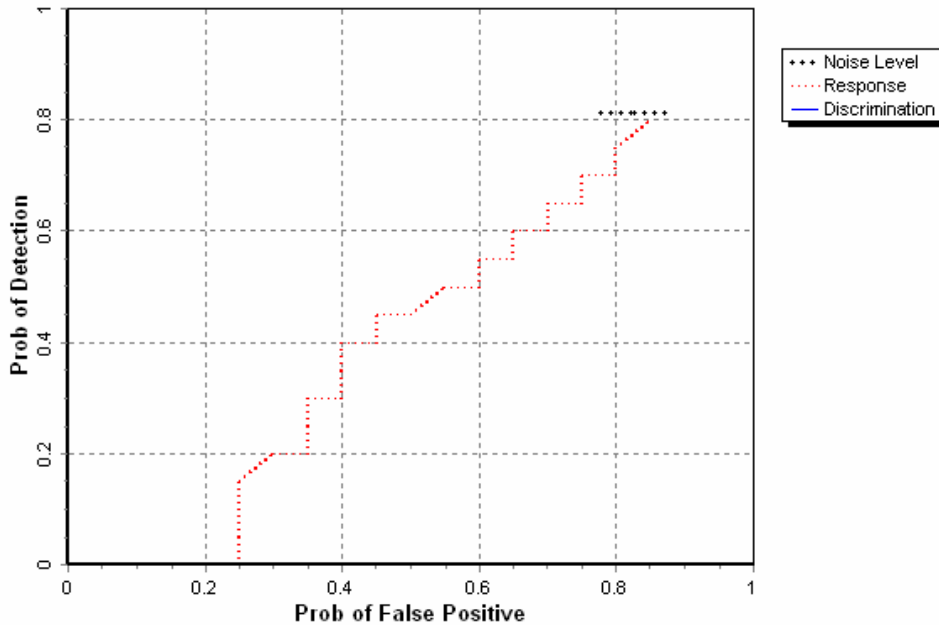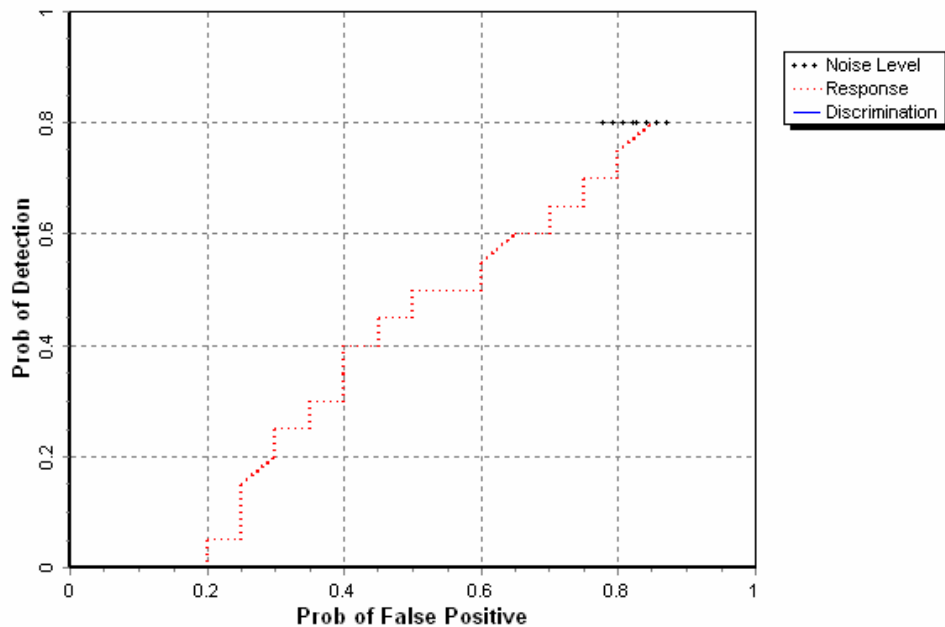
Figure 4. AN/PSS-14/handheld blind grid probability of detection for response and discrimination stages versus their respective probability of false positive for all ordnance larger than 20 mm.
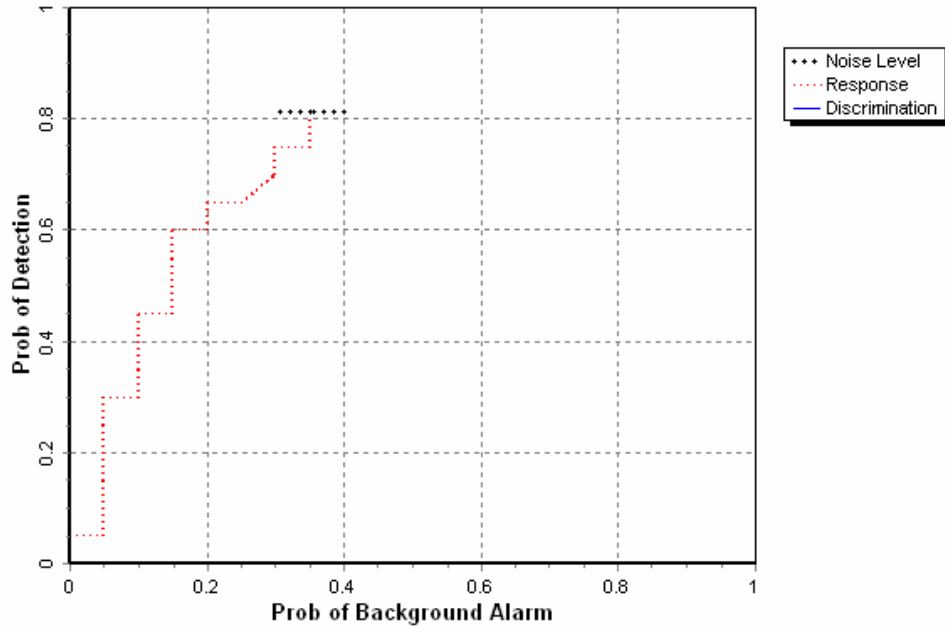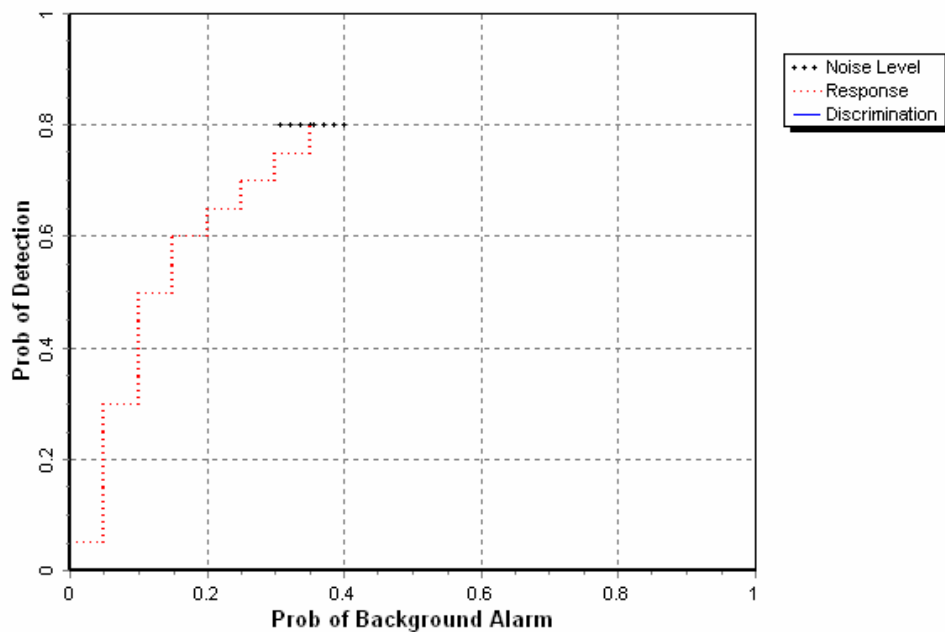

Figure 5. AN/PSS-14/handheld blind grid probability of detection for response and discrimination stages versus their respective probabilities of background alarm for all ordnance larger than 20 mm.

4.3 PERFORMANCE SUMMARIES

Results for the blind grid test broken out by size, depth, and nonstandard ordnance are presented in Table 5 (for cost results, see section 5). Results by size and depth include both standard and nonstandard ordnance. The results by size show how well the demonstrator did at detecting/discriminating ordnance of a certain caliber range (see app A for size definitions). The results are relative to the number of ordnance items emplaced. Depth is measured from the geometric center of anomalies.

The RESPONSE STAGE results are derived from the list of anomalies above the demonstrator-provided noise level. The results for the DISCRIMINATION STAGE are derived from the demonstrator's recommended threshold for optimizing UXO field cleanup by minimizing false digs and maximizing ordnance recovery. The lower 90 percent confidence limit on probability of detection and P_{fp} was calculated assuming that the number of detections and false positives are binomially distributed random variables. All results in Table 5 have been rounded to protect the ground truth. However, lower confidence limits were calculated using actual results.

TABLE 5. SUMMARY OF BLIND GRID RESULTS FOR THE AN\PSS-14/HANDHELD

Metric	Overall	Standard	Nonstandard	By Size			By Depth, m		
				Small	Medium	Large	< 0.3	0.3 to <1	>= 1
RESPONSE STAGE									
P_d	0.80	0.80	0.85	0.80	0.85	0.70	0.95	0.65	0.80
P_d Low 90% Conf	0.75	0.71	0.72	0.72	0.74	0.45	0.89	0.54	0.63
P_d Upper 90% Conf	0.87	0.87	0.91	0.89	0.92	0.88	1.00	0.76	0.93
P_{fp}	0.85	-	-	-	-	-	1.00	0.75	0.50
P_{fp} Low 90% Conf	0.77	-	-	-	-	-	0.91	0.64	0.20
P_d Upper 90% Conf	0.88	-	-	-	-	-	1.00	0.82	0.80
P_{ba}	0.35	-	-	-	-	-	-	-	-
DISCRIMINATION STAGE									
P_d	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_d Low 90% Conf	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_d Upper 90% Conf	NA	NA	NA	NA	NA	NA	NA	NA	NA
P_{fp}	NA	-	-	-	-	-	NA	NA	NA
P_{fp} Low 90% Conf	NA	-	-	-	-	-	NA	NA	NA
P_d Upper 90% Conf	NA	-	-	-	-	-	NA	NA	NA
P_{ba}	NA	-	-	-	-	-	-	-	-

Response Stage Noise Level: 0.50.
Recommended Discrimination Stage Threshold: NA.
NA = not available

Note: The recommended discrimination stage threshold values are provided by the demonstrator.

4.4 EFFICIENCY, REJECTION RATES, AND TYPE CLASSIFICATION

Efficiency and rejection rates are calculated to quantify the discrimination ability at specific points of interest on the ROC curve: (1) at the point where no decrease in P_d is suffered (i.e., the efficiency is by definition equal to one) and (2) at the operator selected threshold. These values are reported in Table 6.

TABLE 6. EFFICIENCY AND REJECTION RATES

	Efficiency (E)	False Positive Rejection Rate	Background Alarm Rejection Rate
At Operating Point	NA	NA	NA
With No Loss of P_d	NA	NA	NA

At the demonstrator's recommended setting, the ordnance items that were detected and correctly discriminated were further scored on whether their correct type could be identified (table 8). Correct type examples include "20-mm projectile, 105-mm HEAT Projectile, and 2.75-inch Rocket." A list of the standard type declaration required for each ordnance item was provided to demonstrators prior to testing. For example, the standard types for the three example items are 20mmP, 105H, and 2.75in, respectively.

TABLE 7.   CORRECT TYPE CLASSIFICATION OF TARGETS CORRECTLY DISCRIMINATED AS UXO

Size	Percentage Correct
Small	NA
Medium	NA
Large	NA
Overall	NA

Note: The demonstrator did not attempt to provide type classification.

4.5 LOCATION ACCURACY

The mean location error and standard deviations appear in Table 8. These calculations are based on average missed depth for ordnance correctly identified in the discrimination stage. Depths are measured from the closest point of the ordnance to the surface. For the Blind Grid, only depth errors are calculated, since (X, Y) positions are known to be the centers of each grid square.

TABLE 8. MEAN LOCATION ERROR AND STANDARD DEVIATION (M)

	Mean	Standard Deviation
Depth	NA	NA

SECTION 5.   ON-SITE LABOR COSTS

A standardized estimate for labor costs associated with this effort was calculated as follows: the first person at the test site was designated "supervisor," the second person was designated "data analyst," and the third and following personnel were considered "field support." Standardized hourly labor rates were charged by title: supervisor at $95.00/hour, data analyst at $57.00/hour, and field support at $28.50/hour.

Government representatives monitored on-site activity.   All on-site activities were grouped into one of ten categories: initial setup/mobilization, daily setup/stop, calibration, collecting data, downtime due to break/lunch, downtime due to equipment failure, downtime due to equipment/data checks or maintenance, downtime due to weather, downtime due to demonstration site issue, or demobilization. See Appendix D for the daily activity log. See section 3.4 for a summary of field activities.

The standardized cost estimate associated with the labor needed to perform the field activities is presented in Table 9. Note that calibration time includes time spent in the calibration lanes as well as field calibrations. "Site survey time" includes daily setup/stop time, collecting data, breaks/lunch, downtime due to equipment/data checks or maintenance, downtime due to failure, and downtime due to weather.

TABLE 9.   ON-SITE LABOR COSTS

	No. People	Hourly Wage	Hours	Cost
Initial Setup				
Supervisor	1	$95.00	1.00	$95.00
Data analyst	0	57.00	1.00	0.00
Field support	0	28.50	1.00	0.00
Subtotal				**$95.00**
Calibration				
Supervisor	1	$95.00	17.42	$1654.90
Data analyst	1	57.00	17.42	992.94
Field support	0	28.50	17.42	0.00
Subtotal				**$2647.84**
Site Survey				
Supervisor	1	$95.00	42.80	$4066.00
Data analyst	1	57.00	42.80	2439.60
Field support	0	28.50	42.80	0.00
Subtotal				**$6505.60**

See notes at end of table.

TABLE 9 (CONT)

	No. People	Hourly Wage	Hours	Cost
Demobilization				
Supervisor	1	$95.00	2.16	$205.20
Data analyst	1	57.00	2.16	$123.12
Field support	0	28.50	2.16	0.00
Subtotal				$328.32
Total				**$9576.76**

Notes: Calibration time includes time spent in the calibration lanes as well as calibration before each data run.

Site survey time includes daily setup/stop time, collecting data, breaks/lunch, downtime due to system maintenance, failure, and weather.

SECTION 6.   COMPARISON OF RESULTS TO DATE

No comparisons to date.

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SECTION 7. APPENDIXES

APPENDIX A. TERMS AND DEFINITIONS

GENERAL DEFINITIONS

Anomaly: Location of a system response deemed to warrant further investigation by the demonstrator for consideration as an emplaced ordnance item.

Detection: An anomaly location that is within R_{halo} of an emplaced ordnance item.

Munitions and Explosives Of Concern (MEC): Specific categories of military munitions that may pose unique explosive safety risks, including UXO as defined in 10 USC 101(e)(5), DMM as defined in 10 USC 2710(e)(2) and/or munitions constituents (e.g. TNT, RDX) as defined in 10 USC 2710(e)(3) that are present in high enough concentrations to pose an explosive hazard.

Emplaced Ordnance: An ordnance item buried by the government at a specified location in the test site.

Emplaced Clutter: A clutter item (i.e., non-ordnance item) buried by the government at a specified location in the test site.

R_{halo}: A pre-determined radius about the periphery of an emplaced item (clutter or ordnance) within which a location identified by the demonstrator as being of interest is considered to be a response from that item. If multiple declarations lie within R_{halo} of any item (clutter or ordnance), the declaration with the highest signal output within the R_{halo} will be utilized. For the purpose of this program, a circular halo 0.5 meters in radius will be placed around the center of the object for all clutter and ordnance items less than 0.6 meters in length. When ordnance items are longer than 0.6 meters, the halo becomes an ellipse where the minor axis remains 1 meter and the major axis is equal to the length of the ordnance plus 1 meter.

Small Ordnance: Caliber of ordnance less than or equal to 40 mm (includes 20-mm projectile, 40-mm projectile, submunitions BLU-26, BLU-63, and M42).

Medium Ordnance: Caliber of ordnance greater than 40 mm and less than or equal to 81 mm (includes 57-mm projectile, 60-mm mortar, 2.75 in. Rocket, MK118 Rockeye, 81-mm mortar).

Large Ordnance: Caliber of ordnance greater than 81 mm (includes 105-mm HEAT, 105-mm projectile, 155-mm projectile, 500-pound bomb).

Shallow: Items buried less than 0.3 meter below ground surface.

Medium: Items buried greater than or equal to 0.3 meter and less than 1 meter below ground surface.

Deep: Items buried greater than or equal to 1 meter below ground surface.

Response Stage Noise Level: The level that represents the point below which anomalies are not considered detectable. Demonstrators are required to provide the recommended noise level for the blind grid test area.

Discrimination Stage Threshold: The demonstrator selected threshold level that they believe provides optimum performance of the system by retaining all detectable ordnance and rejecting the maximum amount of clutter. This level defines the subset of anomalies the demonstrator would recommend digging based on discrimination.

Binomially Distributed Random Variable: A random variable of the type which has only two possible outcomes, say success and failure, is repeated for n independent trials with the probability p of success and the probability 1-p of failure being the same for each trial.   The number of successes x observed in the n trials is an estimate of p and is considered to be a binomially distributed random variable.

RESPONSE AND DISCRIMINATION STAGE DATA

The scoring of the demonstrator's performance is conducted in two stages. These two stages are termed the RESPONSE STAGE and DISCRIMINATION STAGE. For both stages, the probability of detection (P_d) and the false alarms are reported as receiver operating characteristic (ROC) curves. False alarms are divided into those anomalies that correspond to emplaced clutter items, measuring the probability of false positive (P_{fp}) and those that do not correspond to any known item, termed background alarms.

The RESPONSE STAGE scoring evaluates the ability of the system to detect emplaced targets without regard to ability to discriminate ordnance from other anomalies. For the RESPONSE STAGE, the demonstrator provides the scoring committee with the location and signal strength of all anomalies that the demonstrator has deemed sufficient to warrant further investigation and/or processing as potential emplaced ordnance items. This list is generated with minimal processing (e.g., this list will include all signals above the system noise threshold). As such, it represents the most inclusive list of anomalies.

The DISCRIMINATION STAGE evaluates the demonstrator's ability to correctly identify ordnance as such, and to reject clutter. For the same locations as in the RESPONSE STAGE anomaly list, the DISCRIMINATION STAGE list contains the output of the algorithms applied in the discrimination-stage processing. This list is prioritized based on the demonstrator's determination that an anomaly location is likely to contain ordnance. Thus, higher output values are indicative of higher confidence that an ordnance item is present at the specified location. For electronic signal processing, priority ranking is based on algorithm output. For other systems, priority ranking is based on human judgment. The demonstrator also selects the threshold that the demonstrator believes will provide "optimum" system performance, (i.e., that retains all the detected ordnance and rejects the maximum amount of clutter).

Note: The two lists provided by the demonstrator contain identical numbers of potential target locations. They differ only in the priority ranking of the declarations.

RESPONSE STAGE DEFINITIONS

Response Stage Probability of Detection (P_d^{res}): P_d^{res} = (No. of response-stage detections)/ (No. of emplaced ordnance in the test site).

Response Stage False Positive (fp^{res}): An anomaly location that is within R_{halo} of an emplaced clutter item.

Response Stage Probability of False Positive (P_{fp}^{res}): P_{fp}^{res} = (No. of response-stage false positives)/(No. of emplaced clutter items).

Response Stage Background Alarm (ba^{res}): An anomaly in a blind grid cell that contains neither emplaced ordnance nor an emplaced clutter item. An anomaly location in the open field or scenarios that is outside R_{halo} of any emplaced ordnance or emplaced clutter item.

Response Stage Probability of Background Alarm (P_{ba}^{res}): Blind Grid only: P_{ba}^{res} = (No. of response-stage background alarms)/(No. of empty grid locations).

Response Stage Background Alarm Rate (BAR^{res}): Open Field only: BAR^{res} = (No. of response-stage background alarms)/(arbitrary constant).

Note that the quantities P_d^{res}, P_{fp}^{res}, P_{ba}^{res}, and BAR^{res} are functions of t^{res}, the threshold applied to the response-stage signal strength. These quantities can therefore be written as $P_d^{res}(t^{res})$, $P_{fp}^{res}(t^{res})$, $P_{ba}^{res}(t^{res})$, and $BAR^{res}(t^{res})$.

DISCRIMINATION STAGE DEFINITIONS

Discrimination: The application of a signal processing algorithm or human judgment to response-stage data that discriminates ordnance from clutter. Discrimination should identify anomalies that the demonstrator has high confidence correspond to ordnance, as well as those that the demonstrator has high confidence correspond to non-ordnance or background returns. The former should be ranked with highest priority and the latter with lowest.

Discrimination Stage Probability of Detection (P_d^{disc}): P_d^{disc} = (No. of discrimination-stage detections)/(No. of emplaced ordnance in the test site).

Discrimination Stage False Positive (fp^{disc}): An anomaly location that is within R_{halo} of an emplaced clutter item.

Discrimination Stage Probability of False Positive (P_{fp}^{disc}): P_{fp}^{disc} = (No. of discrimination stage false positives)/(No. of emplaced clutter items).

Discrimination Stage Background Alarm (ba^{disc}): An anomaly in a blind grid cell that contains neither emplaced ordnance nor an emplaced clutter item. An anomaly location in the open field or scenarios that is outside R_{halo} of any emplaced ordnance or emplaced clutter item.

Discrimination Stage Probability of Background Alarm (P_{ba}^{disc}): P_{ba}^{disc} = (No. of discrimination-stage background alarms)/(No. of empty grid locations).

Discrimination Stage Background Alarm Rate (BAR^{disc}): BAR^{disc} = (No. of discrimination-stage background alarms)/(arbitrary constant).

Note that the quantities P_d^{disc}, P_{fp}^{disc}, P_{ba}^{disc}, and BAR^{disc} are functions of t^{disc}, the threshold applied to the discrimination-stage signal strength. These quantities can therefore be written as $P_d^{disc}(t^{disc})$, $P_{fp}^{disc}(t^{disc})$, $P_{ba}^{disc}(t^{disc})$, and $BAR^{disc}(t^{disc})$.

RECEIVER-OPERATING CHARACERISTIC (ROC) CURVES

ROC curves at both the response and discrimination stages can be constructed based on the above definitions. The ROC curves plot the relationship between P_d versus P_{fp} and P_d versus BAR or P_{ba} as the threshold applied to the signal strength is varied from its minimum (t_{min}) to its maximum (t_{max}) value.[1] Figure A-1 shows how P_d versus P_{fp} and P_d versus BAR are combined into ROC curves. Note that the "res" and "disc" superscripts have been suppressed from all the variables for clarity.
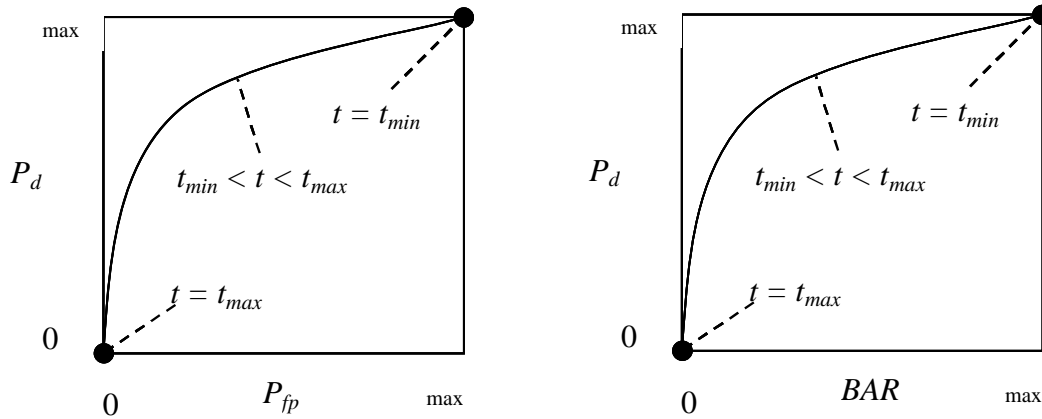
Figure A-1. ROC curves for open field testing. Each curve applies to both the response and discrimination stages.

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[1]Strictly speaking, ROC curves plot the P_d versus P_{ba} over a pre-determined and fixed number of detection opportunities (some of the opportunities are located over ordnance and others are located over clutter or blank spots). In an open field scenario, each system suppresses its signal strength reports until some bare-minimum signal response is received by the system. Consequently, the open field ROC curves do not have information from low signal-output locations, and, furthermore, different contractors report their signals over a different set of locations on the ground. These ROC curves are thus not true to the strict definition of ROC curves as defined in textbooks on detection theory. Note, however, that the ROC curves obtained in the blind grid test sites are true ROC curves.

METRICS TO CHARACTERIZE THE DISCRIMINATION STAGE

The demonstrator is also scored on efficiency and rejection ratio, which measure the effectiveness of the discrimination stage processing. The goal of discrimination is to retain the greatest number of ordnance detections from the anomaly list, while rejecting the maximum number of anomalies arising from non-ordnance items. The efficiency measures the amount of detected ordnance retained by the discrimination, while the rejection ratio measures the fraction of false alarms rejected. Both measures are defined relative to the entire response list, i.e., the maximum ordnance detectable by the sensor and its accompanying false positive rate or background alarm rate.

Efficiency (E): $E = P_d^{disc}(t^{disc})/P_d^{res}(t_{min}^{res})$; Measures (at a threshold of interest), the degree to which the maximum theoretical detection performance of the sensor system (as determined by the response stage t_{min}) is preserved after application of discrimination techniques. Efficiency is a number between 0 and 1. An efficiency of 1 implies that all of the ordnance initially detected in the response stage was retained at the specified threshold in the discrimination stage, t^{disc}.

False Positive Rejection Rate (R_{fp}): $R_{fp} = 1 - [P_{fp}^{disc}(t^{disc})/P_{fp}^{res}(t_{min}^{res})]$; Measures (at a threshold of interest), the degree to which the sensor system's false positive performance is improved over the maximum false positive performance (as determined by the response stage tmin). The rejection rate is a number between 0 and 1. A rejection rate of 1 implies that all emplaced clutter initially detected in the response stage were correctly rejected at the specified threshold in the discrimination stage.

Background Alarm Rejection Rate (R_{ba}):

Blind grid: $R_{ba} = 1 - [P_{ba}^{disc}(t^{disc})/P_{ba}^{res}(t_{min}^{res})]$.
Open field: $R_{ba} = 1 - [BAR^{disc}(t^{disc})/BAR^{res}(t_{min}^{res})])$.

Measures the degree to which the discrimination stage correctly rejects background alarms initially detected in the response stage. The rejection rate is a number between 0 and 1. A rejection rate of 1 implies that all background alarms initially detected in the response stage were rejected at the specified threshold in the discrimination stage.

CHI-SQUARE COMPARISON EXPLANATION:

The Chi-square test for differences in probabilities (or 2 x 2 contingency table) is used to analyze two samples drawn from two different populations to see if both populations have the same or different proportions of elements in a certain category. More specifically, two random samples are drawn, one from each population, to test the null hypothesis that the probability of event A (some specified event) is the same for both populations (ref 3).

A 2 x 2 contingency table is used in the Standardized UXO Technology Demonstration Site Program to determine if there is reason to believe that the proportion of ordnance correctly detected/discriminated by demonstrator X's system is significantly degraded by the more challenging terrain feature introduced. The test statistic of the 2 x 2 contingency table is the

Chi-square distribution with one degree of freedom. Since an association between the more challenging terrain feature and relatively degraded performance is sought, a one-sided test is performed. A significance level of 0.05 is chosen which sets a critical decision limit of 2.71 from the Chi-square distribution with one degree of freedom. It is a critical decision limit because if the test statistic calculated from the data exceeds this value, the two proportions tested will be considered significantly different. If the test statistic calculated from the data is less than this value, the two proportions tested will be considered not significantly different.

An exception must be applied when either a 0 or 100 percent success rate occurs in the sample data. The Chi-square test cannot be used in these instances. Instead, Fischer's test is used and the critical decision limit for one-sided tests is the chosen significance level, which in this case is 0.05. With Fischer's test, if the test statistic is less than the critical value, the proportions are considered to be significantly different.

Standardized UXO Technology Demonstration Site examples, where blind grid results are compared to those from the open field and open field results are compared to those from one of the scenarios, follow. It should be noted that a significant result does not prove a cause and effect relationship exists between the two populations of interest; however, it does serve as a tool to indicate that one data set has experienced a degradation in system performance at a large enough level than can be accounted for merely by chance or random variation. Note also that a result that is not significant indicates that there is not enough evidence to declare that anything more than chance or random variation within the same population is at work between the two data sets being compared.

Demonstrator X achieves the following overall results after surveying each of the three progressively more difficult areas using the same system (results indicate the number of ordnance detected divided by the number of ordnance emplaced):

	Blind grid	Open field	Moguls
P_d^{res}	100/100 = 1.0	8/10 = .80	20/33 = .61
P_d^{disc}	80/100 = 0.80	6/10 = .60	8/33 = .24

P_d^{res}: BLIND GRID versus OPEN FIELD. Using the example data above to compare probabilities of detection in the response stage, all 100 ordnance out of 100 emplaced ordnance items were detected in the blind grid while 8 ordnance out of 10 emplaced were detected in the open field. Fischer's test must be used since a 100 percent success rate occurs in the data. Fischer's test uses the four input values to calculate a test statistic of 0.0075 that is compared against the critical value of 0.05. Since the test statistic is less than the critical value, the smaller response stage detection rate (0.80) is considered to be significantly less at the 0.05 level of significance. While a significant result does not prove a cause and effect relationship exists between the change in survey area and degradation in performance, it does indicate that the detection ability of demonstrator X's system seems to have been degraded in the open field relative to results from the blind grid using the same system.

P_d^{disc}: BLIND GRID versus OPEN FIELD. Using the example data above to compare probabilities of detection in the discrimination stage, 80 out of 100 emplaced ordnance items were correctly discriminated as ordnance in blind grid testing while 6 ordnance out of 10 emplaced were correctly discriminated as such in open field-testing. Those four values are used to calculate a test statistic of 1.12. Since the test statistic is less than the critical value of 2.71, the two discrimination stage detection rates are considered to be not significantly different at the 0.05 level of significance.

P_d^{res}: OPEN FIELD versus MOGULS. Using the example data above to compare probabilities of detection in the response stage, 8 out of 10 and 20 out of 33 are used to calculate a test statistic of 0.56. Since the test statistic is less than the critical value of 2.71, the two response stage detection rates are considered to be not significantly different at the 0.05 level of significance.

P_d^{disc}: OPEN FIELD versus MOGULS. Using the example data above to compare probabilities of detection in the discrimination stage, 6 out of 10 and 8 out of 33 are used to calculate a test statistic of 2.98. Since the test statistic is greater than the critical value of 2.71, the smaller discrimination stage detection rate is considered to be significantly less at the 0.05 level of significance. While a significant result does not prove a cause and effect relationship exists between the change in survey area and degradation in performance, it does indicate that the ability of demonstrator X to correctly discriminate seems to have been degraded by the mogul terrain relative to results from the flat open field using the same system.

APPENDIX B.   DAILY WEATHER LOGS

Date, 2006	Time, EST	Avg Temp, °F	Max Temp, °F	Min Temp, °F	Avg RH, %	Total Precip, in.
17 July	0700	78.0	81.9	72.5	88	0.00
17 July	0800	84.2	86.8	81.4	72	0.00
17 July	0900	87.5	89.0	86.2	61	0.00
17 July	1000	90.0	91.7	88.5	57	0.00
17 July	1100	91.0	91.9	90.1	57	0.00
17 July	1200	92.7	93.9	91.7	54	0.00
17 July	1300	94.1	94.9	93.5	47	0.00
17 July	1400	95.0	95.7	94.3	47	0.00
17 July	1500	96.0	96.8	95.3	47	0.00
17 July	1600	95.8	96.6	95.1	48	0.00
17 July	1700	94.7	96.6	93.3	54	0.00
19 July	0700	72.5	74.7	70.5	99	0.00
19 July	0800	76.4	78.5	74.3	91	0.00
19 July	0900	80.0	81.8	78.1	78	0.00
19 July	1000	81.6	83.1	80.5	74	0.00
19 July	1100	83.5	84.9	82.3	70	0.00
19 July	1200	84.9	85.7	83.9	69	0.00
19 July	1300	86.0	87.2	85.0	61	0.00
19 July	1400	87.2	88.1	86.2	60	0.00
19 July	1500	88.2	89.2	87.5	56	0.00
19 July	1600	89.2	89.9	88.7	53	0.00
19 July	1700	88.8	89.5	88.2	58	0.00
20 July	0700	74.6	75.6	73.5	94	0.00
20 July	0800	76.6	78.5	74.0	88	0.00
20 July	0900	79.3	80.1	78.1	82	0.00
20 July	1000	80.8	82.4	79.6	78	0.00
20 July	1100	82.3	83.9	80.5	75	0.00
20 July	1200	84.4	86.5	82.6	69	0.00
20 July	1300	85.8	86.9	84.8	64	0.00
20 July	1400	86.4	88.2	85.1	64	0.00
20 July	1500	87.9	88.9	86.9	60	0.00
20 July	1600	88.3	89.2	87.1	57	0.00
20 July	1700	88.9	90.4	87.8	57	0.00
24 July	0700	69.0	72.3	65.6	91	0.00
24 July	0800	74.8	78.3	72.2	73	0.00
24 July	0900	78.6	80.0	77.7	62	0.00
24 July	1000	80.7	82.1	79.5	58	0.00
24 July	1100	82.5	83.9	81.7	53	0.00
24 July	1200	83.7	85.1	82.6	51	0.00
24 July	1300	84.4	85.0	83.8	50	0.00

Date, 2006	Time, EST	Avg Temp, °F	Max Temp, °F	Min Temp, °F	Avg RH, %	Total Precip, in.
24 July	1400	85.5	86.6	84.8	47	0.00
24 July	1500	85.6	86.2	84.9	49	0.00
24 July	1600	85.9	86.4	85.3	46	0.00
24 July	1700	85.5	86.3	84.9	50	0.00
25 July	0700	73.9	76.8	71.1	96	0.00
25 July	0800	77.3	78.5	76.4	88	0.00
25 July	0900	79.2	80.3	78.0	84	0.00
25 July	1000	80.5	81.3	79.4	80	0.00
25 July	1100	80.9	81.7	79.9	80	0.00
25 July	1200	81.7	83.1	80.9	75	0.00
25 July	1300	83.0	83.7	82.0	68	0.00
25 July	1400	84.2	84.9	83.4	64	0.00
25 July	1500	84.6	85.5	83.8	60	0.00
25 July	1600	84.5	85.0	83.8	63	0.00
25 July	1700	84.2	84.7	83.2	67	0.00
26 July	0700	76.0	78.9	72.8	97	0.00
26 July	0800	79.5	81.8	77.9	89	0.00
26 July	0900	81.5	83.1	79.7	79	0.00
26 July	1000	83.7	84.9	83.0	72	0.00
26 July	1100	85.0	86.1	84.2	69	0.00
26 July	1200	85.4	86.6	84.5	69	0.00
26 July	1300	86.7	87.7	85.6	58	0.00
26 July	1400	87.5	87.9	86.9	56	0.00
26 July	1500	87.4	88.2	86.9	58	0.00
26 July	1600	87.2	87.8	86.8	55	0.00
26 July	1700	86.8	87.5	86.1	55	0.00
27 July	0700	79.6	80.6	78.9	90	0.00
27 July	0800	81.3	82.5	80.3	87	0.00
27 July	0900	82.6	84.2	81.0	84	0.00
27 July	1000	85.0	86.1	83.8	78	0.00
27 July	1100	87.0	87.9	85.9	75	0.00
27 July	1200	88.1	89.3	87.1	74	0.00
27 July	1300	89.2	90.4	88.4	69	0.00
27 July	1400	90.8	91.7	89.8	59	0.00
27 July	1500	91.3	91.8	90.8	59	0.00
27 July	1600	90.4	91.7	88.2	60	0.00
27 July	1700	87.4	88.7	85.8	73	0.00
28 July	0700	76.8	79.2	74.3	100	0.00
28 July	0800	81.0	82.1	78.9	95	0.00
28 July	0900	82.8	84.4	81.1	89	0.00
28 July	1000	84.4	85.9	83.2	84	0.00
28 July	1100	86.8	88.4	85.5	80	0.00
28 July	1200	88.9	90.2	87.6	73	0.00

Date, 2006	Time, EST	Avg Temp, °F	Max Temp, °F	Min Temp, °F	Avg RH, %	Total Precip, in.
28 July	1300	90.7	91.4	89.9	64	0.00
28 July	1400	82.8	90.5	78.6	78	0.00
28 July	1500	83.9	86.0	80.8	78	0.00
28 July	1600	84.7	85.4	83.9	66	0.00
28 July	1700	86.2	87.5	84.9	63	0.00
31 July	0700	78.5	83.0	75.0	93	0.00
31 July	0800	83.1	84.3	81.7	82	0.00
31 July	0900	86.1	88.0	83.9	75	0.00
31 July	1000	87.7	89.1	86.7	72	0.00
31 July	1100	89.5	90.5	88.4	66	0.00
31 July	1200	91.3	92.4	90.0	61	0.00
31 July	1300	91.7	92.9	91.0	66	0.00
31 July	1400	90.5	92.0	89.3	68	0.00
31 July	1500	90.7	91.9	89.4	67	0.00
31 July	1600	82.8	90.4	75.0	79	0.00
31 July	1700	79.8	83.0	76.5	87	0.00
1 August	0700	80.5	83.0	78.4	93	0.00
1 August	0800	85.0	87.3	82.8	82	0.00
1 August	0900	88.6	90.0	86.9	74	0.00
1 August	1000	91.2	92.3	89.9	69	0.00
1 August	1100	92.1	93.0	91.3	68	0.00
1 August	1200	93.4	94.2	92.5	66	0.00
1 August	1300	94.4	95.3	93.6	65	0.00
1 August	1400	95.0	95.9	93.9	63	0.00
1 August	1500	95.2	96.6	94.3	63	0.00
1 August	1600	94.5	94.9	93.9	65	0.00
1 August	1700	93.5	94.4	93.0	67	0.00
3 August	0700	82.0	84.0	79.6	88	0.00
3 August	0800	85.6	87.7	83.9	79	0.00
3 August	0900	88.8	90.5	87.2	72	0.00
3 August	1000	91.3	92.2	90.1	66	0.00
3 August	1100	92.8	94.2	91.7	63	0.00
3 August	1200	94.4	95.0	93.6	60	0.00
3 August	1300	95.4	96.1	94.8	59	0.00
3 August	1400	96.7	97.3	95.9	54	0.00
3 August	1500	97.1	97.6	96.6	51	0.00
3 August	1600	96.9	97.5	96.4	50	0.00
3 August	1700	96.4	96.9	95.6	51	0.00

APPENDIX C.   SOIL MOISTURE

Date: 17 July 2006			
Times: NA			
Probe Location:	**Layer, in.**	**AM Reading, %**	**PM Reading, %**
Wet area	0 to 6	NA	
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Wooded area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Open area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Calibration lanes	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Blind grid/moguls/mine	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		

Date: 19 July 2006			
Times: 1000 and 1500 hours			
Probe Location:	**Layer, in.**	**AM Reading, %**	**PM Reading, %**
Wet area	0 to 6	NA	
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Wooded area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Open area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Calibration lanes	0 to 6	12.8	12.6
	6 to 12	28.4	28.3
	12 to 24	29.4	29.3
	24 to 36	26.3	26.4
	36 to 48	29.4	29.4
Blind grid/moguls/mine	0 to 6	13.2	13.2
	6 to 12	19.6	19.4
	12 to 24	21.6	21.5
	24 to 36	23.8	23.7
	36 to 48	25.8	25.7

Date: 20 July 2006			
Times: 0900 and 1600 hours			
Probe Location:	**Layer, in.**	**AM Reading, %**	**PM Reading, %**
Wet area	0 to 6	NA	
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Wooded area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Open area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Calibration lanes	0 to 6	12.6	12.5
	6 to 12	28.2	28.2
	12 to 24	29.3	29.3
	24 to 36	26.1	25.9
	36 to 48	29.2	29.1
Blind grid/moguls/mine	0 to 6	13.0	12.9
	6 to 12	19.3	19.2
	12 to 24	21.5	21.4
	24 to 36	23.5	23.4
	36 to 48	25.4	25.3

Date: 24 July 2006			
Times: 0800 and 1500 hours			
Probe Location:	**Layer, in.**	**AM Reading, %**	**PM Reading, %**
Wet area	0 to 6	NA	
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Wooded area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Open area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Calibration lanes	0 to 6	12.1	12.1
	6 to 12	27.7	27.5
	12 to 24	29.0	29.0
	24 to 36	25.7	25.6
	36 to 48	29.0	28.8
Blind grid/moguls/mine	0 to 6	12.7	12.6
	6 to 12	19.1	19.0
	12 to 24	21.2	21.1
	24 to 36	23.2	23.2
	36 to 48	25.0	25.0

Date: 25 July 2006			
Times: 1000 and 1400 hours			
Probe Location:	**Layer, in.**	**AM Reading, %**	**PM Reading, %**
Wet area	0 to 6	NA	
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Wooded area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Open area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Calibration lanes	0 to 6	11.8	11.7
	6 to 12	27.4	27.3
	12 to 24	28.8	28.7
	24 to 36	25.3	25.2
	36 to 48	28.6	28.6
Blind grid/moguls/mine	0 to 6	12.4	12.3
	6 to 12	18.8	18.7
	12 to 24	20.8	20.7
	24 to 36	23.0	22.9
	36 to 48	24.7	24.6

Date: 26 July 2006			
Times: 1000 and 1415 hours			
Probe Location:	**Layer, in.**	**AM Reading, %**	**PM Reading, %**
Wet area	0 to 6	NA	
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Wooded area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Open area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Calibration lanes	0 to 6	11.5	11.4
	6 to 12	27.2	27.1
	12 to 24	28.6	28.5
	24 to 36	25.2	25.1
	36 to 48	28.3	28.3
Blind grid/moguls/mine	0 to 6	12.2	12.1
	6 to 12	18.7	18.5
	12 to 24	20.6	20.4
	24 to 36	22.6	22.7
	36 to 48	24.5	24.3

Date: 27 July 2006			
Times: 800 and 1500 hours			
Probe Location:	**Layer, in.**	**AM Reading, %**	**PM Reading, %**
Wet area	0 to 6	NA	
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Wooded area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Open area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Calibration lanes	0 to 6	11.2	11.1
	6 to 12	26.9	26.8
	12 to 24	28.3	28.2
	24 to 36	24.8	24.7
	36 to 48	28.2	28.1
Blind grid/moguls	0 to 6	12.1	12.0
	6 to 12	18.5	18.2
	12 to 24	20.3	20.2
	24 to 36	22.5	22.4
	36 to 48	24.2	24.2

Date: 28 July 2006			
Times: 0900 and 1430 hours			
Probe Location:	**Layer, in.**	**AM Reading, %**	**PM Reading, %**
Wet area	0 to 6	NA	
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Wooded area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Open area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Calibration lanes	0 to 6	10.8	10.7
	6 to 12	26.5	26.4
	12 to 24	28.0	27.9
	24 to 36	24.5	24.4
	36 to 48	28.0	27.8
Blind grid/moguls/mine	0 to 6	11.8	11.6
	6 to 12	18.0	17.9
	12 to 24	20.0	20.0
	24 to 36	22.2	22.1
	36 to 48	24.1	24.0

Date: 31 July 2006			
Times: 1000 and 1400 hours			
Probe Location:	**Layer, in.**	**AM Reading, %**	**PM Reading, %**
Wet area	0 to 6	NA	
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Wooded area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Open area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Calibration lanes	0 to 6	10.5	10.4
	6 to 12	26.2	26.3
	12 to 24	27.7	27.6
	24 to 36	24.4	24.2
	36 to 48	27.7	27.5
Blind grid/moguls/mine	0 to 6	11.4	11.3
	6 to 12	17.7	17.6
	12 to 24	19.7	19.6
	24 to 36	22.0	22.0
	36 to 48	23.7	23.6

Date: 1 August 2006			
Times: 1000 and 1330 hours			
Probe Location:	**Layer, in.**	**AM Reading, %**	**PM Reading, %**
Wet area	0 to 6	NA	
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Wooded area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Open area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Calibration lanes	0 to 6	10.3	10.2
	6 to 12	26.1	26.0
	12 to 24	27.4	27.2
	24 to 36	24.1	24.0
	36 to 48	27.3	27.1
Blind grid/moguls/mine	0 to 6	11.2	11.1
	6 to 12	17.4	17.3
	12 to 24	19.3	19.2
	24 to 36	21.8	21.7
	36 to 48	23.3	23.2

Date: 3 August 2006			
Times: 900 and 1330 hours			
Probe Location:	**Layer, in.**	**AM Reading, %**	**PM Reading, %**
Wet area	0 to 6	NA	
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Wooded area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Open area	0 to 6		
	6 to 12		
	12 to 24		
	24 to 36		
	36 to 48		
Calibration lanes	0 to 6	9.8	9.6
	6 to 12	25.5	25.3
	12 to 24	26.8	26.6
	24 to 36	23.5	23.4
	36 to 48	26.6	26.5
Blind grid/moguls/mine	0 to 6	10.8	10.7
	6 to 12	17.0	17.0
	12 to 24	18.7	18.6
	24 to 36	21.2	21.1
	36 to 48	22.7	22.6

C-11

Date, 2006	No. of People	Area-Tested	Status Start Time	Status Stop Time	Duration min.	Operational Status	Operational Status - Comments	Track Method	Track Method=Other Explain	Pattern	Field Conditions
17 July	1	CALIBRATION LANES	0900	1000	60	INITIAL SET-UP		GPS	NA	LINEAR	SUNNY, HOT
19 July	1	CALIBRATION LANES	1310	1350	40	DAILY START, STOP	EQUIPMENT SET UP	GPS	NA	LINEAR	SUNNY, HOT
19 July	1	CALIBRATION LANES	1350	1540	110	COLLECTING DATA		GPS	NA	LINEAR	SUNNY, HOT
19 July	1	CALIBRATION LANES	1540	1550	10	BREAK/LUNCH		GPS	NA	LINEAR	SUNNY, HOT
19 July	1	CALIBRATION LANES	1550	1635	45	COLLECTING DATA		GPS	NA	LINEAR	SUNNY, HOT
19 July	1	CALIBRATION LANES	1635	1645	10	DAILY START, STOP	EQUIPMENT BREAKDOWN	GPS	NA	LINEAR	SUNNY, HOT
20 July	1	CALIBRATION LANES	0745	1000	135	DOWNTIME DUE TO EQUIP MAINT/CHECK	DATA CHECK	GPS	NA	LINEAR	SUNNY, HOT
20 July	1	CALIBRATION LANES	1000	1110	70	DAILY START, STOP	EQUIPMENT SET UP	GPS	NA	LINEAR	SUNNY, HOT
20 July	1	CALIBRATION LANES	1110	1145	35	BREAK/LUNCH		GPS	NA	LINEAR	SUNNY, HOT
20 July	1	CALIBRATION LANES	1145	1305	80	COLLECTING DATA		GPS	NA	LINEAR	SUNNY, HOT
20 July	1	CALIBRATION LANES	1305	1310	5	BREAK/LUNCH		GPS	NA	LINEAR	SUNNY, HOT
20 July	1	CALIBRATION LANES	1310	1455	105	COLLECTING DATA		GPS	NA	LINEAR	SUNNY, HOT
20 July	1	CALIBRATION LANES	1455	1510	15	DOWNTIME DUE TO EQUIP MAINT/CHECK	DATA CHECK	GPS	NA	LINEAR	SUNNY, HOT
20 July	1	CALIBRATION LANES	1510	1520	10	DAILY START, STOP	EQUIPMENT BREAKDOWN	GPS	NA	LINEAR	SUNNY, HOT
24 July	2	CALIBRATION LANES	0815	0910	55	DAILY START, STOP	EQUIPMENT SET UP	GPS	NA	LINEAR	SUNNY, HOT
24 July	2	CALIBRATION LANES	0910	1030	80	COLLECTING DATA		GPS	NA	LINEAR	SUNNY, HOT
24 July	2	CALIBRATION LANES	1030	1045	15	BREAK/LUNCH		GPS	NA	LINEAR	SUNNY, HOT
24 July	2	CALIBRATION LANES	1045	1125	40	COLLECTING DATA		GPS	NA	LINEAR	SUNNY, HOT

Note: Activities pertinent to this specific demonstration are indicated in highlighted text.

Date, 2006	No. of People	Area-Tested	Status Start Time	Status Stop Time	Duration min.	Operational Status	Operational Status - Comments	Track Method	Track Method=Other Explain	Pattern	Field Conditions
24 July	2	CALIBRATION LANES	1125	1215	50	BREAK/LUNCH		GPS	NA	LINEAR	SUNNY, HOT
24 July	2	CALIBRATION LANES	1215	1430	135	DOWNTIME DUE TO EQUIP MAINT/CHECK	DATA CHECK	GPS	NA	LINEAR	SUNNY, HOT
24 July	2	MINE GRID	1430	1515	45	COLLECTING DATA		GPS	NA	LINEAR	SUNNY, HOT
24 July	2	MINE GRID	1515	1525	10	BREAK/LUNCH		GPS	NA	LINEAR	SUNNY, HOT
24 July	2	MINE GRID	1525	1640	75	COLLECTING DATA		GPS	NA	LINEAR	SUNNY, HOT
24 July	2	MINE GRID	1640	1705	25	DAILY START, STOP	EQUIPMENT BREAKDOWN	GPS	NA	LINEAR	SUNNY, HOT
25 July	2	MINE GRID	0755	1010	135	DAILY START, STOP	EQUIPMENT SET UP	GPS	NA	LINEAR	CLOUDY, WARM
25 July	2	MINE GRID	1010	1100	50	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
25 July	2	MINE GRID	1100	1115	15	BREAK/LUNCH		GPS	NA	LINEAR	CLOUDY, WARM
25 July	2	MINE GRID	1115	1220	65	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
25 July	2	MINE GRID	1220	1255	35	BREAK/LUNCH		GPS	NA	LINEAR	CLOUDY, WARM
25 July	2	MINE GRID	1255	1520	145	DOWNTIME DUE TO EQUIP MAINT/CHECK		GPS	NA	LINEAR	CLOUDY, WARM
25 July	2	BLIND TEST GRID	1520	1600	40	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
25 July	2	BLIND TEST GRID	1600	1630	30	BREAK/LUNCH		GPS	NA	LINEAR	CLOUDY, WARM
25 July	2	BLIND TEST GRID	1630	1650	20	DAILY START, STOP	EQUIPMENT BREAKDOWN	GPS	NA	LINEAR	CLOUDY, WARM
26 July	2	BLIND TEST GRID	1000	1020	20	DAILY START, STOP	EQUIPMENT SET UP	GPS	NA	LINEAR	CLOUDY, WARM
26 July	2	BLIND TEST GRID	1020	1135	75	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
26 July	2	BLIND TEST GRID	1135	1250	75	BREAK/LUNCH	LUNCH	GPS	NA	LINEAR	CLOUDY, WARM

Note: Activities pertinent to this specific demonstration are indicated in highlighted text.

Date, 2006	No. of People	Area-Tested	Status Start Time	Status Stop Time	Duration min.	Operational Status	Operational Status - Comments	Track Method	Track Method=Other Explain	Pattern	Field Conditions
26 July	2	BLIND TEST GRID	1250	1445	115	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
26 July	2	BLIND TEST GRID	1445	1625	100	DOWNTIME DUE TO EQUIP MAINT/CHECK	DATA CHECK	GPS	NA	LINEAR	CLOUDY, WARM
27 July	2	BLIND TEST GRID	0745	0835	50	DAILY START, STOP	EQUIPMENT SET UP	GPS	NA	LINEAR	CLOUDY, WARM
27 July	2	BLIND TEST GRID	0835	0950	75	DOWNTIME DUE TO EQUIP MAINT/CHECK	DATA CHECK	GPS	NA	LINEAR	CLOUDY, WARM
27 July	2	BLIND TEST GRID	0950	1110	80	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
27 July	2	BLIND TEST GRID	1110	1355	165	BREAK/LUNCH	LUNCH	GPS	NA	LINEAR	CLOUDY, WARM
27 July	2	BLIND TEST GRID	1355	1445	50	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
27 July	2	BLIND TEST GRID	1445	1555	70	BREAK/LUNCH		GPS	NA	LINEAR	CLOUDY, WARM
27 July	2	BLIND TEST GRID	1555	1645	50	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
27 July	2	BLIND TEST GRID	1645	1710	25	DAILY START, STOP	EQUIPMENT BREAKDOWN	GPS	NA	LINEAR	CLOUDY, WARM
28 July	2	BLIND TEST GRID	0835	0940	65	DAILY START, STOP	EQUIPMENT SET UP	GPS	NA	LINEAR	CLOUDY, WARM
28 July	2	BLIND TEST GRID	0940	1105	85	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
28 July	2	BLIND TEST GRID	1105	1150	45	BREAK/LUNCH		GPS	NA	LINEAR	CLOUDY, WARM
28 July	2	BLIND TEST GRID	1150	1305	75	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
28 July	2	BLIND TEST GRID	1305	1400	55	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
28 July	2	BLIND TEST GRID	1400	1445	45	WEATHER ISSUE	LIGHTNING ADVISORY	GPS	NA	LINEAR	CLOUDY, WARM
28 July	2	BLIND TEST GRID	1445	1455	10	DAILY START, STOP	EQUIPMENT BREAKDOWN	GPS	NA	LINEAR	CLOUDY, WARM
31 July	2	BLIND TEST GRID	0810	0845	35	DAILY START, STOP	EQUIPMENT SET UP	GPS	NA	LINEAR	CLOUDY, WARM

Note: Activities pertinent to this specific demonstration are indicated in highlighted text.

Date, 2006	No. of People	Area-Tested	Status Start Time	Status Stop Time	Duration min.	Operational Status	Operational Status - Comments	Track Method	Track Method=Other Explain	Pattern	Field Conditions
31 July	2	BLIND TEST GRID	0845	1105	140	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
31 July	2	BLIND TEST GRID	1105	1150	45	BREAK/LUNCH	LUNCH	GPS	NA	LINEAR	CLOUDY, WARM
31 July	2	BLIND TEST GRID	1150	1300	70	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
31 July	2	BLIND TEST GRID	1300	1315	15	BREAK/LUNCH		GPS	NA	LINEAR	CLOUDY, WARM
31 July	2	BLIND TEST GRID	1315	1325	10	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
31 July	2	BLIND TEST GRID	1325	1400	35	BREAK/LUNCH		GPS	NA	LINEAR	CLOUDY, WARM
31 July	2	BLIND TEST GRID	1400	1555	115	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
31 July	2	BLIND TEST GRID	1555	1615	20	DAILY START, STOP	EQUIPMENT BREAKDOWN	GPS	NA	LINEAR	CLOUDY, WARM
1 August	2	BLIND TEST GRID	0840	0920	40	DAILY START, STOP	EQUIPMENT SET UP	GPS	NA	LINEAR	CLOUDY, WARM
1 August	2	BLIND TEST GRID	0920	1125	125	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
1 August	2	BLIND TEST GRID	1125	1210	45	BREAK/LUNCH	LUNCH	GPS	NA	LINEAR	CLOUDY, WARM
1 August	2	BLIND TEST GRID	1210	1235	25	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
1 August	2	BLIND TEST GRID	1235	1250	15	BREAK/LUNCH		GPS	NA	LINEAR	CLOUDY, WARM
1 August	2	BLIND TEST GRID	1250	1455	125	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
1 August	2	BLIND TEST GRID	1455	1515	20	BREAK/LUNCH		GPS	NA	LINEAR	CLOUDY, WARM
1 August	2	BLIND TEST GRID	1515	1605	50	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
1 August	2	BLIND TEST GRID	1605	1630	25	DAILY START, STOP	EQUIPMENT BREAKDOWN	GPS	NA	LINEAR	CLOUDY, WARM
3 August	2	BLIND TEST GRID	0645	0805	80	DAILY START, STOP	EQUIPMENT SET UP	GPS	NA	LINEAR	CLOUDY, WARM
3 August	2	BLIND TEST GRID	0805	0940	95	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM

Note: Activities pertinent to this specific demonstration are indicated in highlighted text.

Date, 2006	No. of People	Area-Tested	Status Start Time	Status Stop Time	Duration min.	Operational Status	Operational Status - Comments	Track Method	Track Method=Other Explain	Pattern	Field Conditions
3 August	2	BLIND TEST GRID	0940	1030	50	BREAK/LUNCH		GPS	NA	LINEAR	CLOUDY, WARM
3 August	2	BLIND TEST GRID	1030	1140	70	COLLECTING DATA		GPS	NA	LINEAR	CLOUDY, WARM
3 August	2	BLIND TEST GRID	1140	1350	130	DEMOBILIZATION		GPS	NA	LINEAR	CLOUDY, WARM

Note: Activities pertinent to this specific demonstration are indicated in highlighted text.

APPENDIX E.   REFERENCES

1. Standardized UXO Technology Demonstration Site Handbook, DTC Project
    No. 8-CO-160-000-473, Report No. ATC-8349, March 2002.

2. Aberdeen Proving Ground Soil Survey Report, October 1998.

3. Data Summary, UXO Standardized Test Site: APG Soils Description, May 2002.

4. Yuma Proving Ground Soil Survey Report, May 2003.

APPENDIX F. ABBREVIATIONS

APG	=	Aberdeen Proving Ground
ATC	=	U.S. Army Aberdeen Test Center
DMM	=	discarded military munitions
EM	=	electromagnetic
ERDC	=	U.S. Army Corps of Engineers Engineering Research and Development Center
ESTCP	=	Environmental Security Technology Certification Program
EQT	=	Army Environmental Quality Technology Program
GPR	=	ground penetrating radar
GPS	=	Global Positioning System
HEAT	=	high-explosive antitank
JPG	=	Jefferson Proving Ground
LULU	=	low-cost utility location unit
MEC	=	munitions and explosives of concern
NA	=	not available
OE	=	
POC	=	point of contact
QA	=	quality assurance
QC	=	quality control
ROC	=	receiver-operating characteristic
RTK	=	real-time kinematic
SERDP	=	Strategic Environmental Research and Development Program
USAEC	=	U.S. Army Environmental Command
UXO	=	unexploded ordnance
YPG	=	U.S. Army Yuma Proving Ground

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